

## ASSESSMENT OF STRIPED SHRIMP, *PANDALUS MONTAGUI*, IN DIVISION 2G (SHRIMP FISHING AREA 4)



Image: Striped Shrimp (*Pandalus montagui*), Fisheries and Oceans Canada, NL Region



**Figure 1. Map of Shrimp Fishing Area (SFA) 4 with the depth contours for that area.**

### Context:

*Striped Shrimp (Pandalus montagui, Leach, 1814) are primarily taken as bycatch during the Northern Shrimp (Pandalus borealis) fishery in shrimp fishing area (SFA) 4 (Figure 1). Prior to 2013, part of this area was included in the management area SFA2-4 West of 63°W. In 2013 these management areas were restructured and SFA 4 became a single management unit, with a bycatch cap established at 4,033 t.*

*Fisheries and Oceans Canada (DFO) Ecosystems and Fisheries Management requested an assessment of Striped Shrimp to inform sound management recommendations for the 2014/15 fishery and to be used in the development of a more comprehensive management plan. The resource was last assessed in 2003 and, starting in 2015, will be assessed on a biennial basis with updates in interim years. The assessment made use of a biomass index from the Northern Shrimp Research Foundation (NSRF)-DFO survey and bycatch records from logbooks in early years, and the Canadian Atlantic Quota Report (CAQR) for the 2013/14 season.*

*This Science Advisory Report is from the January 23, 2014 Regional Peer Review Meeting-Assessment of Striped Shrimp in SFA 4. Additional publications from this meeting will be posted on the [Fisheries and Oceans Canada \(DFO\) Science Advisory Schedule](#) as they become available.*

## SUMMARY

- Catches of Striped Shrimp, mainly taken as bycatch at the Northern fringe of SFA 4, increased from 280 t in 2008 to 4,710 t in 2012 before declining to approximately 1,860 t in 2013/14 (CAQR January 21, 2014)
- The fishable biomass index for Striped Shrimp in SFA 4 decreased by 70 % from 36,100 t in 2008 to 11,000 t in 2011 then tripled to 35,800 t by 2013.
- The female spawning stock biomass for Striped Shrimp in SFA 4 is unknown.
- The exploitation rate index for Striped Shrimp in SFA 4 varied between 1 % in 2008 and 29 % in 2011. If the bycatch limit of 4,033 t was taken in 2013/14, the exploitation rate index would be 11 %.
- The potential exploitation rate index of 11 %, as well as its upper confidence limit, is below the 20 % maximum exploitation rate that is proposed for SFA 4 Northern Shrimp.

## BACKGROUND

### Species Distribution and Stock Boundaries

Striped Shrimp are found in the Northwest Atlantic from Davis Strait south to the Bay of Fundy. They prefer a hard bottom and are typically found in cold waters (-1°- 2°) at depths of 100-300 m. Their temperature, depth and bottom type preferences differ slightly from those of Northern Shrimp however, their populations overlap; the extent of the overlap has not been examined.

Striped Shrimp are found over a wide area. While management boundaries are, to some extent, arbitrary and chosen for convenience, the northern edge of SFA 4 is an especially inconvenient place for a boundary; applying a similar harvest strategy across all areas mitigates the consequence of potential boundary issues. In addition to being found in SFA 4, Striped Shrimp are found in the Western and Eastern Assessment Zones, directly to the north of SFA 4. Hudson Strait is a highly dynamic system with strong currents and mixing. Shrimp could be transported great distances in a relatively short period of time, resulting in rapid shifts of shrimp into and out of SFA 4.

### Species Biology

Striped Shrimp are protandric hermaphrodites; they first mature as males, mate as males for one to several years and then change sex to spend the rest of their lives as mature females. They are known to live for more than eight years in some areas. Some northern populations exhibit slower rates of growth and maturation but greater longevity resulting in larger maximum size. Females produce eggs in the late summer-fall and carry the eggs on their pleopods until they hatch in the spring. Shrimp often undergo vertical migrations up into the water column at night and are opportunistic feeders. They are important as forage species in the ecosystem.

### Fishery

Prior to 2013, part of SFA 4 was included in the management unit SFA 2, 3, 4 west of 63°W. New management measures, mainly for the restructuring of SFA 2 and 3, came into effect for the 2013/14 fishing season which also eliminated all multiple SFA management units in SFAs 2 -4. Consequently, SFA 4 became a single management unit for Northern and Striped

Shrimp. Additional management measures designating SFA 4 Striped Shrimp as a bycatch only fishery, with a harvest limit of 4,033 t, were also implemented in 2013/14. Northern Shrimp is the target shrimp species in SFA 4, with Striped Shrimp being taken as bycatch. Generally Northern Shrimp are more valuable and marketable than Striped Shrimp and, depending on market conditions, vessels often move away from Striped Shrimp areas in order to reduce the bycatch. In some recent years, the market price for Striped Shrimp has improved, though there continue to be market constraints.

While the fishery is open year-round, ice conditions dictate when the area can be fished; it typically takes place from early summer to late fall or early winter. Moreover, the catch of Striped Shrimp is mainly at the northern fringe of SFA 4 (north of 60°N), rather than being distributed over the same area as the population (Figure 2).

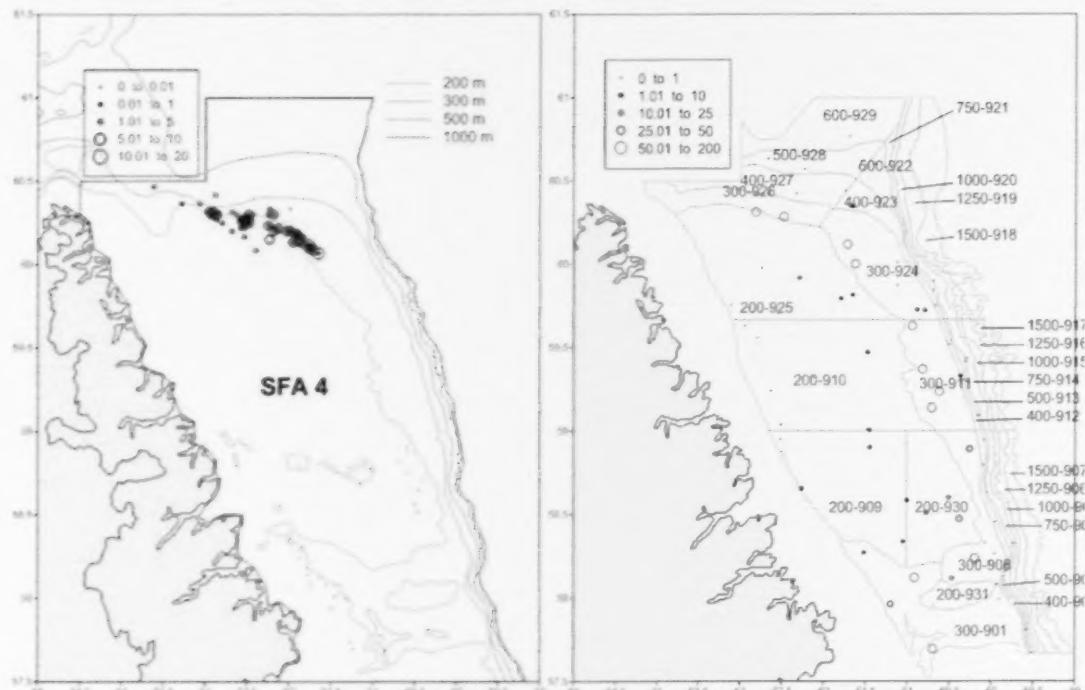


Figure 2. Maps of SFA 4 Striped Shrimp distribution in 2013. Commercial catch (tonnes) is displayed in the left panel along with depth contours of the SFA. Survey catch (kg/15 minute tow) is displayed in the right panel along with the stratification scheme for the SFA.

## ASSESSMENT

The assessment of Striped Shrimp in SFA 4 was based on trends in fishable biomass from the NSRF -DFO survey and commercial catch. The fishable biomass index is the weight of all shrimp with carapace lengths > 17 mm. The exploitation rate index is calculated as the total catch divided by the fishable biomass index, expressed as a percentage. Catch data were derived from commercial fishing logbooks and the CAQR.

## Commercial Fishery

Catches of Striped Shrimp, mainly taken as bycatch at the northern fringe of SFA 4, increased from 280 t in 2008 to 4,710 t in 2012 before declining to approximately 1,860 t in 2013/14 (CAQR January 21, 2014) (Figure 3).

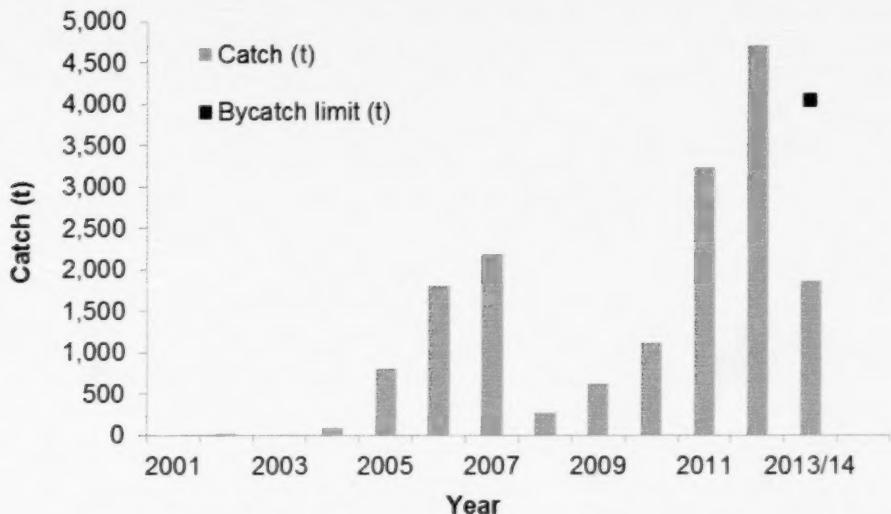


Figure 3. Striped Shrimp catches for the period 2002 -2013/14 along with the bycatch limit established for 2013/14. The catches from 2002 -12 are based on log books within calendar year whereas the catch from 2013/14 is based on the CAQR value (updated Jan. 21, 2014) within management year.

## Biomass

The annual NSRF-DFO bottom trawl survey has taken place in SFA 4 each July beginning in 2005. The highest survey catches of Striped Shrimp come from depths less than 300 m. The fishable biomass index for Striped Shrimp in SFA 4 decreased by 70 % from 36,100 t in 2008 to 11,000 t in 2011 then tripled to 35,800 t by 2013 (Figure 4).

The female spawning stock biomass (SSB) that is relevant to the precautionary approach for an area consists of the animals whose spawning products will ultimately be caught in that area (as opposed to the animals that spawn *in* the area). The strong currents that likely advect all sizes of shrimp, especially larvae, into SFA 4 create especially severe problems with estimating female SSB for this particular SFA. The true female SSB is more than the females observed by the survey alone within SFA 4. Therefore, female SSB for Striped Shrimp is unknown in SFA 4.

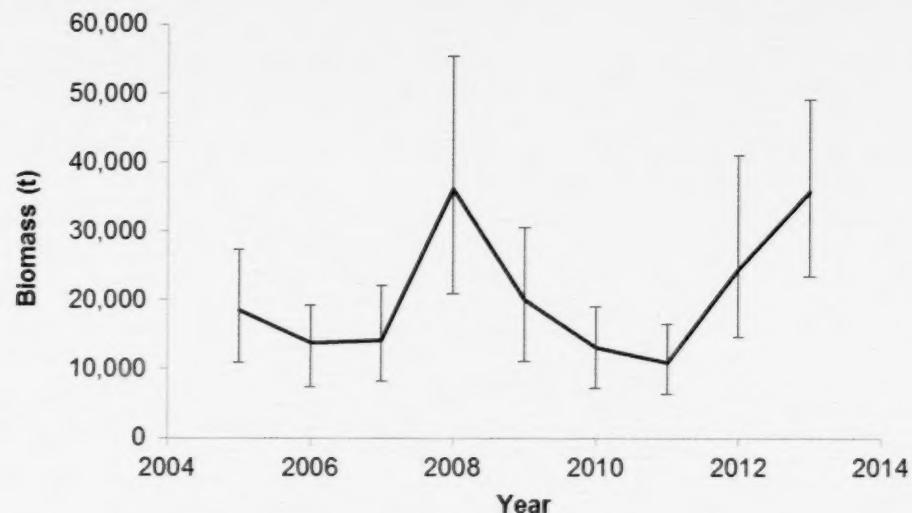


Figure 4. SFA 4 Fishable biomass index with error bars providing 95 % confidence intervals.

## Mortality

The exploitation rate index for Striped Shrimp in SFA 4 varied between 1 % in 2008 and 29 % in 2011. If the bycatch limit of 4,033 t was taken in 2013/14, the exploitation rate index would be 11 % (Figure 5). However, the exploitation rate is far from spatially uniform. A large fraction of the fishable biomass estimated from the survey is in a region that is never fished; therefore the local exploitation rate in the small area fished in the north is far greater than the nominal exploitation rate.

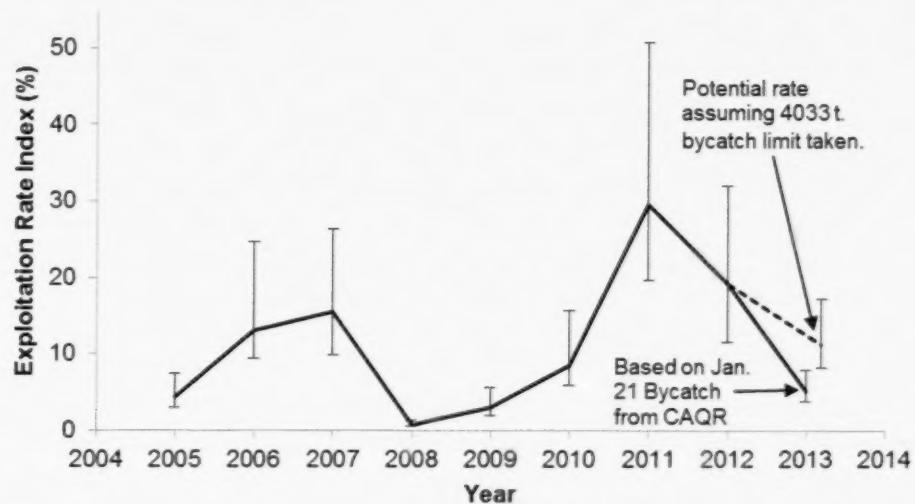


Figure 5. SFA 4 exploitation rate index based on the total catch/fishable biomass index, expressed as a percentage. Error bars indicate 95 % confidence intervals.

## Sources of Uncertainty

Striped Shrimp are also found to the north of SFA 4. The area near the mouth of Hudson Strait has strong currents that could rapidly move these shrimp in and out of SFA 4. For this reason, it is unknown if increases and decreases in biomass indices represent changes in the resource or movement in and out of this SFA. For such reasons, recruitment prospects are unknown.

It is possible that the decline in the catch of Striped Shrimp in 2013/14 was due to market and operational reasons rather than a decline in resource availability.

The survey in SFA 4 had been conducted by the *Cape Ballard* from 2005 to 2011. Beginning in 2012, the *Aqviq* was used after the *Cape Ballard* became unserviceable. Because vessel specifications were similar and there was no change in the survey gear or design, it was assumed that any effect of this change in the survey vessel would not be significant. However, no inter-calibration was conducted. Also in 2012 the survey protocol was not followed in that the warp ratio was shortened; these changes could have affected trawl performance.

For the exploitation rate calculation, both the denominator and numerator are uncertain. Trawls used in the surveys have shrimp catchability less than one but the exact value is unknown. Therefore, the survey underestimates biomass by an unknown amount. Although the commercial catch is known, the total fishery-induced mortality is unknown (landed catch plus incidental mortality from trawling). Therefore the exploitation rate index overestimates the exploitation rate by an unknown amount.

Physical changes in the environment may affect the distribution and hence the availability of shrimp to commercial and survey trawls.

## CONCLUSION

The potential exploitation rate index of 11 %, as well as its upper confidence limit, is below the 20 % maximum exploitation rate that is proposed for a healthy SFA 4 Northern Shrimp resource. However, without an estimate of female SSB, the status of the Striped Shrimp resource relative to a Precautionary Approach Framework could not be determined.

## OTHER CONSIDERATIONS

There are concerns about the exploitation rate calculated for this resource. The exploitable biomass is distributed throughout SFA 4 whereas the catch comes from a localized northern portion of the SFA. A single exploitation rate averaged over fished and unfished portions of the stock will be misleading if used as a basis for local decisions. It is unknown what level of exploitation is precautionary for Striped Shrimp in SFA 4. However, continued fishing solely in the north could lead to local depletion in that area.

The current Integrated Fisheries Management Plan (IFMP) for Northern and Striped Shrimp recognizes that shrimp is an important forage species and therefore shrimp management has adopted a more conservative approach than that for a single species management approach. A better understanding of ecosystem demands on shrimp as forage species is required.

## SOURCES OF INFORMATION

This Science Advisory Report is from the January 23, 2014 Regional Peer Review Meeting – Assessment of Striped Shrimp in SFA4. Additional publications from this meeting will be posted on the [Fisheries and Oceans Canada \(DFO\) Science Advisory Schedule](#) as they become available.

DFO. 2007. Integrated Fisheries Management Plan: Northern Shrimp – Shrimp Fishing Areas (SFAs) 0-7 and the Flemish Cap. Commercial Fishing, Integrated Fisheries Management Plans.

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MPO. 2014. Évaluation de la crevette ésope, *Pandalus montagui*, dans la division 2G (zone de pêche de la crevette 4) Secr. can. de consult. sci. du MPO. Avis sci. 2014/020.